FULL LENGTH ARTICLE

Comparison between intra-venous versus intra-arterial heparin during transradial coronary artery catheterization

Mohammed Almansori [a,*], Shady Ouf [a]

[a] Department of Medicine, Division of Cardiology, University of Dammam

[a] Saudi Arabia

Background: **Trans-radial coronary artery catheterization is gaining popularity, heparin has been proven to reduce the rate of radial artery occlusion, intra-venous or intra-arterial heparin have no effect on the radial artery occlusion, we investigate the effect of route of heparin administration on different procedure related parameters.**

Methods: **We randomized 150 consecutive patients to receive intra-venous (75 patients) or intra-arterial (75 patients) heparin; the two groups were compared regarding different procedure related parameters.**

Results: **The success rate was over 99% and rate of radial artery spasm was about 5%. There was no statistically significant difference between the two groups regarding the parameters tested.**

Conclusion: **The trans-radial angiography can be performed successfully in the Saudi population, Studies with larger sample size are needed to show a significant difference between intra-arterial and intra-venous heparin administration.**

Keywords: Radial, Heparin, Angiography

Introduction

Trans-radial coronary procedures were first described by Campeau in 1989 [1], and over the past few years these procedures have increased due to significant reduction in site-related complications and increased patient convenience [2,3]. Radial artery occlusion is a known potential complication of trans-radial procedures, and heparin has been shown to reduce the incidence of this complication [4,5]. Some operators administer heparin through the intra-venous route while others use the intra-arterial route. One study has shown no significant difference in the rate of radial artery occlusion between the two routes [6]. However, the effects of either one of these heparin administration routes on the procedure itself are not known.

Methods

We randomized 150 consecutive patients planned for elective diagnostic coronary angiogra-

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* Corresponding author. Address: University of Dammam, PO Box 12875, Dammam 31483, Saudi Arabia. Tel.: +966 545 30 7447; fax: +966 3 896 6741.
E-mail address: malmansori@gmail.com (M. Almansori).

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P.O. Box 2925 Riyadh – 11461KSA
Tel: +966 1 2520088 ext 40151
Fax: +966 1 2520718
Email: sha@sha.org.sa
URL: www.sha.org.sa

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phy through transradial approach to receive intra-venous (75 patients) or intra-arterial heparin (75 patients). Inadequate arterial circulation to the hand as indicated by Allen's test and the presence of coronary artery bypass grafts were the only exclusion criteria. Patients were given heparin according to their weight (50 units/Kg up to maximum of 5000 units of heparin). All patients received 100 mcg of nitroglycerin and 1 mg of verapamil intra-radially after radial sheath insertion as vasodilators to minimize radial artery spasm. Angiography was performed utilizing femoral curve 6F diagnostic coronary catheters. All patients provided informed consent. The two groups were compared through various procedure-related parameters, which included: procedure success, defined as the ability to complete the diagnostic angiogram through the radial artery; radial artery spasm, defined as pain induced by catheter manipulation or by angiographic narrowing of the artery that resolved with vasodilators; procedure duration, defined as the interval between sheath insertion and the end of the diagnostic coronary angiography; radiation exposure time and dose; dose area product (DAP); and contrast volume used during the diagnostic coronary angiography. The hospital's Scientific and Ethics Committee approved the study protocol.

The data and baseline characteristics were computed using means and standard deviations for continuous variables and percentages for dichotomous variables. The P-values for the comparison groups was calculated using *t*-test for continuous data and chi-square test for the dichotomous data.

Results

Table 1 shows no statistically significant difference between the venous and the arterial groups in relation to the baseline characteristics of the patients. Table 2 shows the comparison between the two groups in relation to various procedure-related parameters. Both groups were comparable. The procedure was unsuccessful in one patient in the venous group due to the presence of a radial loop that could not be passed and required femoral artery access to complete the coronary angiography. Radial artery spasm was noticed in 6.7% in the venous group versus 4% in the arterial group (p value = 0.719).

Discussion

Transradial coronary artery catheterization has gained progressive acceptance by interventional cardiologists as it provides enhanced patient comfort and reduces bleeding complications. It also has the potential for being performed on an outpatient basis [7,8]. Our study is the first to compare intra-venous and intra-arterial administration of heparin in relation to the effects on the procedure itself. The study showed that

Table 1. Baseline clinical characteristics of patients.

Characteristic*	Venous $N = 75$	Arterial $N = 75$	*P*-value
Age, years	55 ± 9.1	55.5 ± 15.5	0.807
Sex (male)	75%	65%	0.285
Weight, kg	79.1 ± 15.5	81 ± 13.6	0.429
Height, cm	162.9 ± 8.2	163.6 ± 8.9	0.620
Smoking	36%	40%	0.737
Hypertension	55%	53%	1.000
Diabetes mellitus	59%	44%	0.102

* Data are presented as mean ± standard deviation or percentages.

Table 3. Procedure parameter for all trans-radial coronary angiograms.

Procedure related parameters*	Trans-radial coronary angiograms $N = 150$
Procedure success	99.3%
Radial artery spasm	5.3%
Procedure duration, min	10.5 ± 4.0
Radiation exposure time, min	3.4 ± 1.6
Radiation exposure dose, mGy	601 ± 208
Dose area product, cGy*N*cm^2	4483 ± 1735
Contrast volume, ml	43 ± 12

* Data are presented as mean ± standard deviation or percentages.

Table 2. Comparison of procedure related parameters between venous and arterial groups.

Procedure related parameters*	Venous $N = 75$	Arterial $N = 75$	*P*-value
Procedure success	98.7%	100%	1.000
Radial artery spasm	6.7%	4%	0.719
Procedure duration, min	10.5 ± 4.2	10.5 ± 3.9	0.968
Radiation exposure time, min	3.5 ± 1.7	3.3 ± 1.5	0.474
Radiation exposure dose, mGy	609 ± 209	593 ± 208	0.641
Dose area product, cGy cm^2	4475 ± 1716	4491 ± 1764	0.956
Contrast volume, ml	43.4 ± 12	43.2 ± 12.5	0.947

* Data are presented as mean ± standard deviation or percentages.

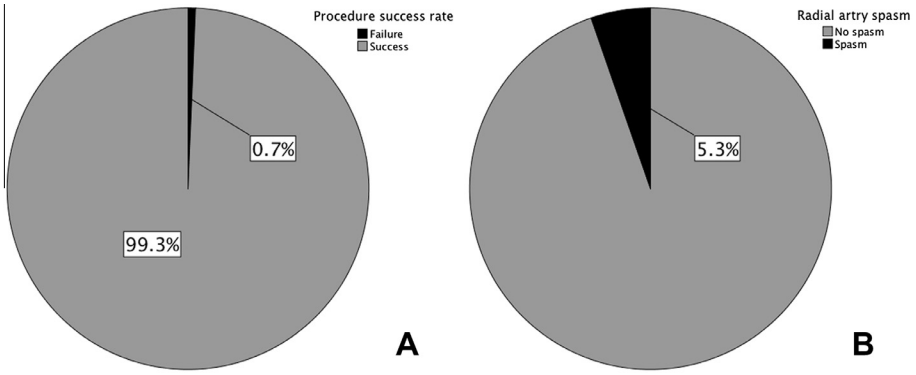

Figure 1. (A) Procedure success rate. (B) Rate of radial artery spasm.

there is no significant difference between the two routes of administration in terms of the various procedure-related parameters carried out.

Our study describes the transradial coronary catheterization experience in a sample from Saudi Arabia. As shown in Table 3 and Fig. 1, in expert hands, the success rate was over 99%, and the procedure was performed in 10.5 ± 4 min, utilizing only 43 ± 12 ml of contrast media. Previous studies from Saudi Arabia showed that operators with less experience in transradial coronary catheterization had a success rate of 99% and a procedure time of about 20 min [9]. In our experience the rate of radial artery spasm was 5.3%. Previous studies have reported spasm rates of up to 34%, depending on operator experience and the use of spasmolytic agents [10,11]. Our study has certain limitations in having a small sample size and in being a single center study.

A post-hoc power calculation carried out at the end of the study showed that a study of such a sample size could achieve a power of 86% if the effect size (standardized measure of difference between the two groups) was medium (0.5). Keeping the same sample size of 150, if the effect size was small (0.2) the power would be low: less than 30%. In this study, the actual effect of sizes are very small. For example, if we take the variable, ''radiation exposure time,'' the effect size would be 0.12 and the total sample size required to achieve a power of 80% would be 1592, which is far beyond the resources available for this study.

In conclusion, subject to the limitation of the small sample size, transradial angiography can be performed successfully on the Saudi population. Additionally, there might be no difference between arterial or venous administration of heparin. However, studies with larger sample sizes are needed to show a significant difference.

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